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(54) Tempering accelerator and use thereof.

(57) A powdery tempering accelerator which comprises powder of stable crystals of a fat or oil which comprises as a main component a 1,3-saturated-2-unsaturated triglyceride the total carbon atoms of the constituent fatty acid residues of which are 50 to 56. A method for using that tempering accelerator is also disclosed.

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TEMPERING ACCELERATOR AND USE THEREOF

The present invention relates to a tempering accelerator which enables a tempering operation (adjusting a temperature) in the production of oily compositions such as chocolate to be omitted or simplified. It also relates to a method for using that tempering accelerator.

Tempering is an important step in the production of oily compositions such as chocolate, nut paste, margarine and the like. Tempering is effected so that a solidified product can be readily released from a mold due to formation of fine crystal nuclei when solidifying. Thereby, a product having good properties such as excellent gloss, lustre, mouth feel and the like can be obtained (see, for example, Japanese Patent Kokai No. 61-40750).

However, in general, the tempering operation is troublesome and there is a tendency to avoid using such a tempering operation. For this purpose, various alternatives have been tried for example, using a hard butter having a high elaidin content, a hard butter wherein the fatty acid arrangement is randomized by interesterification, or a lauric hard butter. However, miscibility of these hard butters with cacao butter is limited and thus the taste and flavor of resulting products are also limited.

Further, regarding methods of tempering, there are optimum conditions for each production depending upon the particular kind of hard butter used, and its composition and oil content as well as the presence of milk solid, but it is not always easy to determine the most suitable conditions. Furthermore, almost all refrigerators used for tempering are not very versatile, and are assembled to operate at a specific cooling rate.

Accordingly, the degree of tempering of chocolate should be adjusted based on the particular type of refrigerator to be used, and it is often found that a particular tempering style should be preliminarily investigated (M. G. Reade, The Manufacture Confectioner/January 1985)

Thus, various methods have been employed for tempering. However, in general, tempering usually involves at least one step of force-cooling a molten oily composition and at least one step of reheating it (see, for example, "Seika Jiten" page 459, October, 1981, published by Asakura Shoten). It is clear that the loss of energy generally becomes greater, when both cooling and subsequent heating are effected in a single apparatus. Therefore, it is necessary to install two kinds of apparatus for cooling and heating (Japanese Patent Kokai No. 61-40750). If tempering can be effected only by cooling, the process is very advantageous from the view point of fewer process steps as well as a decrease in energy and apparatus. Further, if the tempering manner can be standardized regardless of the kind of chocolate or refrigerator, the range of conditions which it is necessary to include in a preliminary study of a particular tempering style can be limited and this is very convenient from the practical view point.

The present inventors have studied intensively, and have found a tempering accelerator of powdery form Which reduces or obviates the problem of miscibility with cacao butter and which enables a tempering operation to be omitted, simplified or standarized.

Thus in accordance with the present invention, there is provided a powdery tempering accelerator which comprises powder of stable crystals of a fat or oil which comprises as a main component 1,3-saturated-2-unsaturated triglyceride the total number of carbon atoms of the constituent fatty acid residues of which is 50 to 56.

The present invention also provides a method for using the tempering accelerator which comprises adding powder particles of stable crystals of a fat or oil which comprises as the main component 1,3-saturated-2-unsaturated triglyceride the total number of carbon atoms of the constituent fatty acid residues of which is 50 to 56 to an oily composition during a step of cooling the composition while preventing melting of the powder particles.

Figs. 1 and 2 of the accompanying drawing are differential scanning calorimeter (DSC) charts of chocolate just after casting in a mold and after cooling at 15° C for 30 minutes in Example 4 hereinafter, respectively.

When the total number of carbon atoms is less than the above range of 50 to 56, the melting temperature of the triglyceride is too low, even if it is in the form of stable crystals. Furthermore, the triglyceride easily dissolves in the oily composition which is to be subjected to tempering and thus, the desired effect of acceleration of tempering can hardly be expected. A greater total of carbon atoms is thus preferred. For example, a fat or oil being rich in 2-oleyl-palmito-stearin which has a total number of carbon atoms of 52 is more preferred than a fat or oil being rich in 2-oleyl-dipalmitin which has a total number of carbon atoms of 50. A fat or oil which is rich in 2-oleyl-distearin having a total number of carbon atoms of 54 and that which is rich in 2-oleyl-stearyl-alachidin having a total number of carbon atoms of 56 are much more preferred. Further, when an accelerator comprising a triglyceride having as the constituent fatty acid

at the 2-position a saturated fatty acid, i.e., a trisaturated triglyceride which is readily obtained from a completely hydrogenated hardened oil, is employed instead of one comprising a 1,3-saturated-2-unsaturated glyceride, good crystal growth can not be accelerated. This results, for example, in difficulty in releasing an oily composition subjected to tempering from a mold after cooling and, even if released the product has an inferior gloss. Furthermore, in the case of an isomer glyceride, i.e., 1,2- or 2,3-saturated-3- or 1-unsaturated glyceride, good crystal growth can also not be accelerated.

The fat or oil comprising as the main component 1,3-saturated-2-unsaturated triglyceride wherein the total number of carbon atoms of the constituent fatty acid residues are 50 to 56 can be prepared from a natural fat or oil such as cacao butter, mowrah butter, illipe butter, shea fat, sal fat, allanblackia fat, mango fat, kokum fat and the like or by fractionating and purifying it. Or, it can be prepared by selectively introducing a saturated fatty acid into the 1- and 3- positions of a fat or oil which is rich in a triglyceride wherein the constituent fatty acid at the 2-position is an unsaturated fatty acid (see, for example, Japanese Patent Kokai Nos. 52-104506, 55-71797 or 56-127094) and fractionating and purifying it, or by chemical synthesis. Generally, when the purity of the above specific triglyceride contained in the powdery fat or oil accelerator is higher, a good result can be more readily obtained; the purity is preferably more than 50% by weight, more preferably more than 70% by weight.

The above fat or oil should be in the form of powder of stable crystals. The term "stable crystals" used herein means a crystal form showing at least 4 peaks of a short lattice spacing (side lattice spacing) in an X-ray diffraction spectrum. Preferably, the crystal form is the IV form or more stable form, more preferably, the V form or more stable form of the cacao butter crystal forms designated by R. L. Wille and E. S. Lutton [J.A.O.C.S., 43, 491-496 (1966)]. If the above fat having the specific composition is not in the form of stable crystals, the accelerating effect of tempering is unlikely to occur. If it is used in the form of liquid, it is difficult to release the product from a mold, unless a conventional tempering is effected. Further, even in the case where the product is used in enrobing, fat blooming is immediately caused.

The stable crystal form can be obtained by aging the triglyceride at a temperature lower than about its melting point (particularly, the melting point of its stable crystal form) for a certain period of time. This aging period can be shortened by using the triglyceride fat in a finely divided form, for example, powder. Further, in general, crystals obtained by forming micelle of a triglyceride with a solvent (e.g., an organic solvent such as hexane, acetone, etc., a supercritical gas) and depositing therefrom are stable even without aging. Therefore such crystals can be used as the stable crystals in the present invention by removing the solvent from the deposited crystals while preventing melting of the crystals (e.g., removal of the solvent under vacuum).

The powder particles can be formed by, for example, spraying the desired molten fat from a spray dryer at a certain temperature, or pulverizing the solid fat in the form of masses or coarse particles alone or together with a dispersion medium described hereinafter. However, in the case where the solid fat is already in the form of stable crystals, it is preferred to carry out pulverization under a low temperature atmosphere at which crystals are not molten, for example, by cooling with dry-ice.

The average particle size of the crystal powder is not more than 500 μm, preferably not more than 100 μm, more preferably not more than 40 μm. When the particle size is too large, tempering can not be effectively accelerated because of decrease in the number of nuclei present to accelerate crystallization, or dispersion in an oily composition becomes inferior and, in some cases, the particles adversely affect mouth feel and impair the edible properties of a product. When the particle size is small, the amount to be used may be decreased. However, attention should be given to prevent particles from melting due to high temperature on their addition to a mix as described hereinafter.

The tempering accelerator of the present invention can contain other powder as a dispersion medium and, when dispersibility is improved, the effect of addition of the accelerator is further enhanced. The dispersion medium is preferably selected from a powder ingredient which can be used as a composition to be subjected to tempering. That is, in the case where a chocolate mix is subjected to tempering, the dispersion medium is conveniantly powder selected from ingredients of a chocolate mix such as saccharides, milk powder, cacao mass, cocoa powder, emulsifying agents and the like. Since, usually, the accelerator is passed through a refiner after addition to a chocolate mix, the particle size of the dispersion medium is preferably not more than 50 μm so as to prevent impairment of mouth feel of the product.

In the method for using the tempering accelerator mentioned above, the accelerator is added during a solidification step with cooling of a molten oily composition while preventing melting of the accelerator.

The oily composition can be mixed materials for chocolate, nut paste, margarine and the like. The term "chocolate" used herein is not limited to chocolate which contains more than a specific amount of cacao butter such as that prescribed by laws and regulations, and includes any kind of chocolate such as that using a hard butter other than cacao butter. Examples of chocolate using a hard butter other than cacao

butter include those obtained by using a so-called non-tempering type hard butter such as a lauric hard butter, a high-elaidin hard butter or a hard butter obtained by non-selective interesterification which does not require any tempering as well as a 1,3-disaturated-2-unsaturated type hard butter. According to the present invention, it is possible to produce chocolate by using a tempering type hard butter together with a non-tempering type hard butter in any mixing proportion including one resulting in viscosity increase or blooming which would make the production impossible according to a conventional manner. Therefore, a considerable amount of cheap non-tempering type hard butter, i.e., 20 to 80% preferably 50 to 80% by weight based on the fat ingredient of chocolate can be used while maintaining good cacao fat flavor. This is advantageous to chocolate production.

Addition of the accelerator is carried out during solidification with cooling of the oily composition and therefore it is preferred to make this addition at a temperature lower than that at which the oily composition (mix) is in a fully molten state (usually, 40 °C or higher). Further, addition of the accelerator should be made in such a manner that the accelerator does not melt due to heat of the oily mix. Thus the accelerator is added at a temperature lower than that at which the accelerator melts fully within a short period of time. In this manner, no reheating process is required and it is possible to cast the mix in a mold or to use the mix in enrobing immediately after dispersion of the accelerator in the chocolate mix. Therefore, when temperatures at which the accelerator are added are higher, tempering can be simplified and, in fact, omitted. On the other hand, when the temperature at which the accelerator is added is higher, the accelerator is liable to melt and an additional amount of the accelerator and quick dispersion thereof are required. Therefore, the temperature should be selected by taking consideration of the balance of these factors. In general, when the total number of carbon atoms of the fatty acid residues which constitute the triglyceride is greater, the temperature can be made higher. Addition of the accelerator can be made in so far as the oily composition (mix) is lost fluidity thereof by over cooling.

Additionally, according to the present invention, chocolate can be produced in the same manner as described above even when a non-tempering type fat is used in an amount of 20 to 80% by weight based on the fat ingredient of the chocolate.

Usually, the accelerator can be added to a chocolate mix in an amount of 0.005 to 10% by weight as the weight of the stable crystal powder of the triglyceride based on the total amount of the fat content in the oily composition. When the amount of addition is too small, the desired effect is unlikely to occur but, when the amount is too large, the effect will not continue to increase.

After addition and dispersion of the accelerator, the resulting chocolate products can be treated in a conventional manner for example, by depositing, casting or enrobing. In this regard, according to the present invention, severe temperature control of a hopper, a piston, and a cylinder of a depositor as well as a tempering mold which is needed for conventional chocolate production is not required.

The following Examples and Reference Examples further illustrate the present invention in detail but are not to be construed to limit the scope thereof. In the Examples and Reference Examples, all "parts" and "%'s" are by weight unless otherwise stated.

Example 1

A high melting point fraction was obtained from Allanblackia extracted oil in a yield of 59.1%. Then, the fraction was aged for a long period of time, frozen in liquid nitrogen and pulverised to obtain a stable crystal powder (average particle size: 11.4 μm) [corresponding to the V form designated by the above R. L. Wille and E. S. Lutton as shown by identification X-ray diffraction (Cu - Kα, λ = 1.542)].

Example 2

Stearic acid ethyl ester and high oleic sunflower oil were subjected to selective interesterification of the 1,3 positions of glycerides by using lipase and the resulting interestified oil was fractionated and concentrated by using a solvent. The fat thus obtained was recrystallized from hexane and the solvent was removed by a vacuum pump while preventing melting of the crystals. Then, the fat was pulverized with cooling by dry-ice in a mixture and passed through a screen to obtain an accelerator having a particle size of 42 to 60 mesh pass (350 to 250 μm). The crystal form of this additive corresponded to the VI form according to the above designation method.

Example 3

A powder was obtained from molten cacao butter by utilizing a spray-dryer. The resulting powder was aged, frozen in liquid nitrogen and pulverised to obtain a stable crystal powder (the above V form) having a particle size of 14.9 μm.

The chemical constants (IV and AV), the fatty acid composition (in the following Table 1, for example, "C 18 : 1" means a fatty acid having 18 carbon atoms with 1 double bond), the melting point (a powder sample was placed in a glass capillary having about 5 mm length and an inner diameter of about 1 mm one end of which was sealed and the capillary was attached to the bulb of a thermometer so that the sealed part was directed to downward. The melting point was measured on a water bath with rising temperature) and HPLC analysis (in the following Table 1, "DG" means diglyceride) of each of the accelerators obtained in Examples 1 to 3 are shown in Table 1.

Table 1

Example		1	2	3
Chemical constant	IV	29.9	30.5	36.8
	AV	0.35	0.04	2.1
Fatty acid composition	C16 : 0	0.6	3.4	25.5
	C18 : 0	64.1	61.0	33.5
	C18 : 1	35.2	31.9	36.4
	C18 : 2	-	2.4	4.0
	C20 : 0	0.1	0.7	0.5
	C22 : 0	-	0.6	-
Melting point (°C)	Beginning of melting	42.4°C	40.7°C	not
	Completion of melting	43.6°C	41.3°C	measured
	DG others	2.1	3.8	0.8
HPLC analysis	POO			2.9
	PLP			2.1
	PLS			3.8
	POP			16.1
	SOO	2.2		3.6
	POS	2.1	16.3	40.1
	SLS			1.7
	SOS	91.2	75.3	26.8
	PPS	0.7	1.8	0.4
	PSS	0.7	1.8	0.5
	SSS	0.7	1.8	
	AOS	1.7	1.4	1.2
	BOS		1.4	

Example 4

Chocolate was produced by using the accelerator of Example 1 or 3. That is, a molten chocolate mix of the following formulation was prepared according to a conventional manner by mixing the ingredients and refining and conching the mixture. The mix was cooled to 30°C and 5% of the above accelerator based on the fat content of the mix (1.67% based on the chocolate mix) was added thereto with stirring and dispersed. Then, the mixture was cast in a mold and solidified by standing at 15°C for 30 minutes.

For comparison, in the same manner as described above, chocolate products were produced except that no accelerator was added and the chocolate mix obtained was cast in a mold at 30°C (Reference Example 1); or the accelerator of Example 1 was admixed with the other ingredient before refining and conching to prepare a molten chocolate mix (Reference Example 2).

Formulation of chocolate

Powdered sugar	44.5%	100 parts
Whole milk powder	20.0%	
Cacao butter	19.8%	
Cacao mass	15.7%	
Lecithin	0.5 parts	

A sample of the chocolate of this Example 4 using the accelerator of Example 1 was obtained at the time when the chocolate cast in a mold at 30°C and analyzed by DSC analysis (collecting the sample (30 to 40 mg) in an aluminum sample pan and setting it in a DSC sample chamber together with a control pan containing no sample, quickly freezing the chamber to -40°C with dry-ice, and then electrically measuring absorbed calorie with rising temperature at the rate of 5°C/min). Likewise, a sample of the chocolate obtained after cooling at 15°C for 30 minutes was analyzed. The resulting data are shown in the accompanying drawings (Figs. 1 and 2). It is clearly shown that stable crystals of the chocolate are rapidly formed. When samples of Reference Example 2 wherein the accelerator of Example 1 was added were subjected to DSC analysis according to the same manner. However, the peak at about 40°C was not observed in both samples obtained at the time the chocolate mixture was cast in a mold, and at the time the chocolate mixture was solidified by standing at 15°C for 30 minutes after casting in a mold.

Releasing properties and gloss of each chocolate product are shown below.

Accelerator	Mean particle size (μm)	Releasability and Gloss*
Ex. 1	11.4	A
Ex. 3	14.9	A
no accelerator (Reference Ex. 2)		C
Ex. 1 (Reference Ex. 1)		C

[Note] *) A: readily released with one or two tappings and good gloss

B: released with 3 to 4 tappings but partial presence of a stripe pattern on the surface

C: difficult to release even with tapping

Example 5

According to the same manner as described in Example 4, a chocolate product was produced except that the accelerator of Example 2 was used as it is, or the accelerator obtained by mixing the accelerator of Example 2 with powdered sugar in the proportion by weight of 1 : 1, freezing in liquid nitrogen and pulverising (average particle size of not more than about 20 μm) was used. Both resulting chocolates showed good release properties and gloss. However, the chocolate obtained by casting the accelerator of Example 2 was inferior in dispersibility and white granular state was observable by the naked eye on the broken surface thereof.

Example 6

According to the same manner as described in Example 4, the product was produced except that the accelator of Example 1 was dispersed in a chocolate mix of the following formulation. When cake was enrobed with the resulting chocolate product and cooled, the product was quickly dried to give good gloss.

According to the same manner, a product (Reference Example) was produced except that the tempering accelerator was molten and admixed with the chocolate mix. In this case, fat blooming occurred immediately after cooling.

Formulation of chocolate		
Powdered sugar	41.0%	100 parts
Whole milk powder	8.1%	
Skim milk powder	5.0%	
Cacao butter	35.0%	
Cacao mass	8.9%	
Cocoa powder	2.0%	
Lecithin	0.5 parts	

Example 7

According to the same manner as described in Example 2, a solvent-removed, unpulverized accelerator was obtained. This was admixed with powdered sugar in the weight ratio of 1 : 1 and frozen-pulverized in liquid nitrogen to obtain powder having an average particle size of about 20 μm or finer. According to the same manner as described in Example 4, chocolate was obtained except that the resulting powder was added in an amount of 1 to 0.01% by weight based on the fat ingredient (accelerator 0.5 to 0.005% by weight based on the fat ingredient). All chocolates thus obtained had good release properties from the mold and good gloss.

Example 8

Formulation of chocolate

Powdered sugar	38.0%	100 parts
Whole milk powder	7.0%	
Cacao mass	30.0%	
Palm oil	20.0%	
Cocoa powder	5.0%	
Lecithin	0.5 parts	
Flavor	small amount	

The above chocolate mix was cooled to 30° C and the accelerator of Example I was added thereto in an amount of 0.1% by weight calculated as the crystalline powder based on the fat ingredient of the mix. The mixture was cast in a mold and solidified by standing at 8° C for 30 minutes. This chocolate had good release properties from the mold and good gloss.

When a conventional tempering was carried out without addition of the accelerator, viscosity was remarkably increased, which made the tempering difficult. And, the product had inferior release properties and gloss.

Example 9

Formulation of chocolate

Powdered milk	45.0%	100 parts
Whole milk powder	14.0%	
High elaidin content hard butter (Melano STM)	21.0%	
Cacao mass	20.0%	
Lecithin	0.5 parts	
Flavor	small amount	

The above chocolate mix was cooled to 30° C and the accelerator of Example 1 was added thereto in an amount of 0.1% by weight calculated as the crystalline powder based on the fat ingredient of the mix. The mixture was cast in a mold and solidified by standing at 5° C for 30 minutes. This chocolate had good release properties from the mold and good gloss.

The production was repeated without addition of the accelerator (Reference Example 3).

Each chocolate obtained was stored at 20° C for 1 week. Then, the chocolate was subjected to a cycle test wherein the chocolate was stored at 17° C for 12 hours and then at 30.5° C for 12 hours and this cycle was repeated. As the result, in the chocolate of Reference Example 3, blooming was observed after 4 weeks, whereas, even after 2 months, no blooming was observed in the chocolate of Example 9.

Claims

1. A powdery tempering accelerator which comprises powder of stable crystals of a fat or oil which comprises as a main component 1,3-saturated-2-unsaturated triglyceride the total number of carbon atoms of the constituent fatty acid residues of which is 50 to 56.

2. A powdery tempering accelerator as claimed in claim 1, which contains a dispersion medium.

3. A powdery tempering accelerator as claimed in claim 2, in which the dispersion medium is selected from powder ingredients of chocolate.

4. A method of using a tempering accelerator which comprises adding powder particles of stable crystals of a fat or oil which comprises as the main component 1,3-saturated-2-unsaturated triglyceride the total number of carbon atoms of the constituent fatty acid residues of which is 50 to 56 to an oily composition during a step of cooling the composition while preventing melting of the powder particles.

5. The use of an accelerator as claimed in any one of claims 1 to 3, in a process for producing chocolate.

6. Chocolate which comprises an accelerator as claimed in any one of claims 1 to 3.

7. Chocolate as claimed in claim 6 which comprises 20 to 80 weight % of a non-tempering type fat based on the fat content of the chocolate.

8. Chocolate as claimed in claim 6 or 7 which comprises 0.005 to 10 weight % of the accelerator based on the fat content of the chocolate.

FIG. 1.

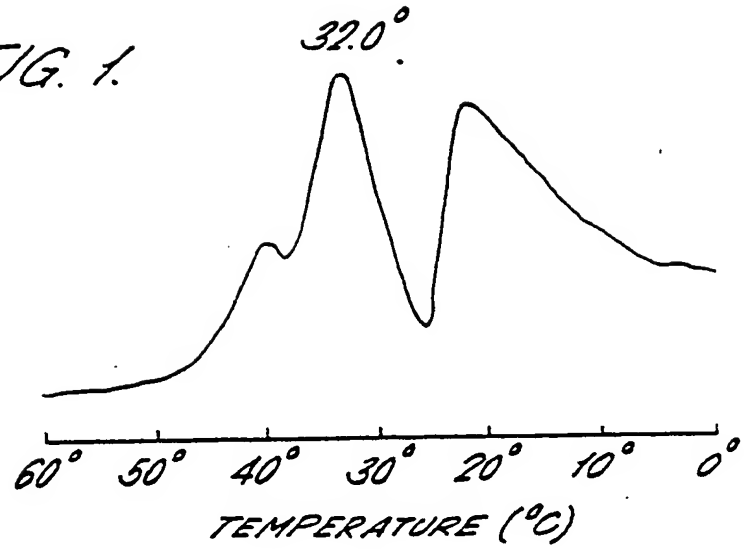

FIG. 2.

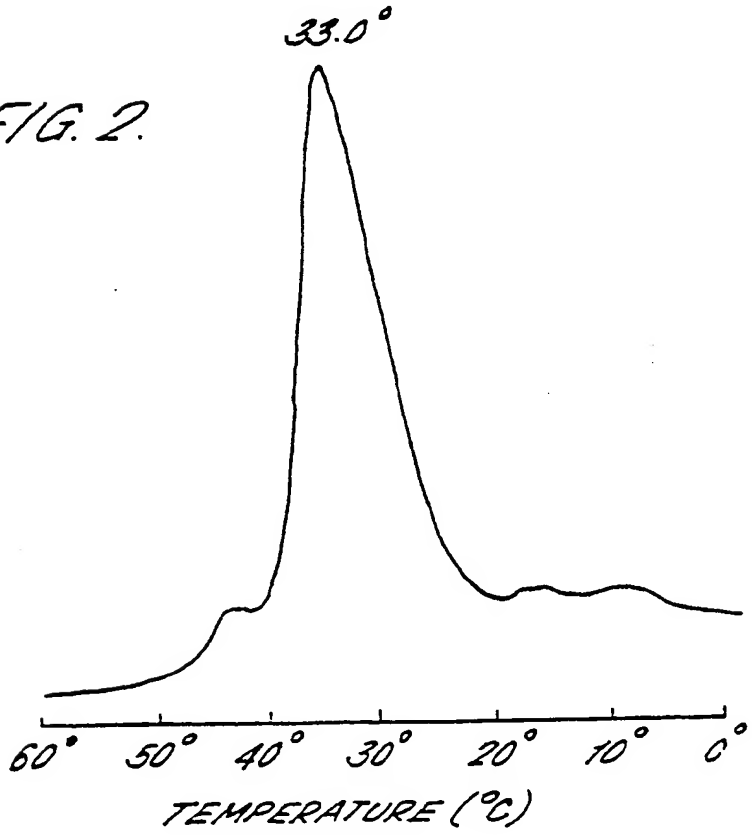

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FIG. 1.

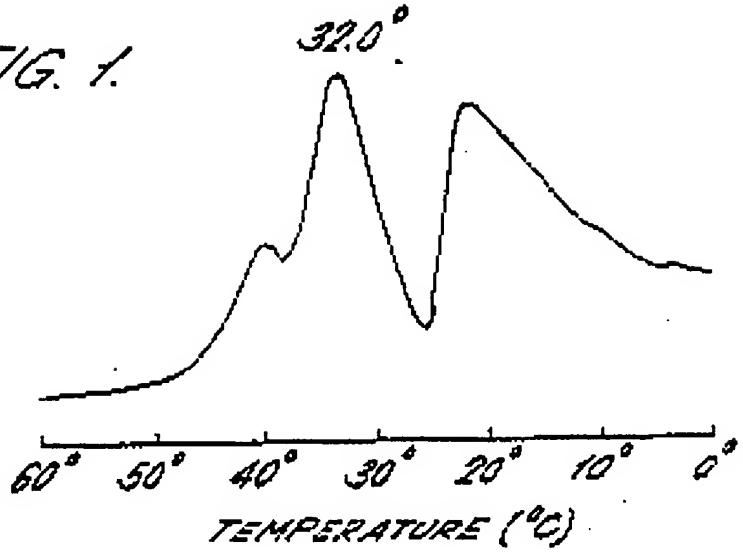
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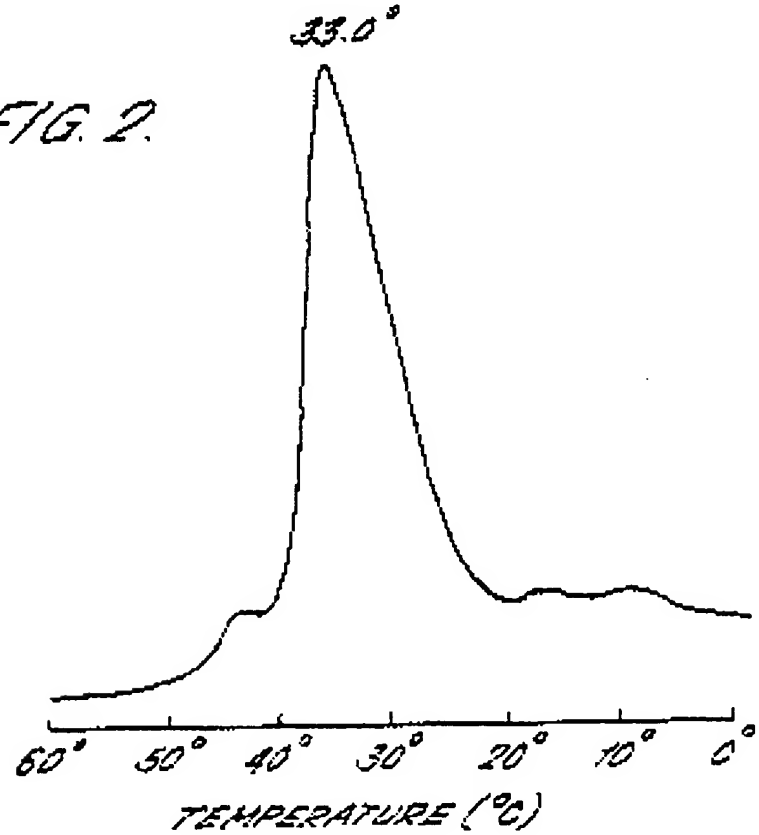
FIG. 2.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TEMPERATURE (°C)

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 4861

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	FR-A-2 334 747 (DYNAMIT NOBEL AG) * Claims; page 3, line 30 - page 4, line 32 *	1,4,5,6,8	A 23 G 1/00 A 23 D 3/02 A 23 G 1/18
Y	---	2,3,7	
Y	EP-A-0 196 780 (KAO CORP.) * Page 4, lines 18-31; page 5, lines 18-24; page 7, line 25 - page 8, line 14; page 14, table 2; examples 1,5 *	2,3,7	
A	--- US-A-3 492 130 (J. HARWOOD) * Claims 1,7; column 1, line 35 - column 2, line 50 *	1	
	-----		TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A 23 G A 23 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21-08-1990	VUILLAMY V.M.L.

CATEGORY OF CITED DOCUMENTS

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